**Budget Justification**

**A. Senior personnel**

Salaries and wages make up the largest part of the proposal expenses. Collaborator Edge will be leading the development of the new proxy archive – laboratory methods development, chronology development, testing of climate-growth relationships, developing new climate reconstructions, and writing papers. 6.75 months of salary per year is requested for this work. The academic year salary is based on the salary for a research faculty position at Northern Arizona University. PI Erb will be supporting the research in the proxy development phase and leading the proxy-model comparison—coding and testing the necessary methodological advancements, conducting analysis, and organizing other aspects of the research effort, including leading one paper. 3 months for each year of the project is requested for this work. This is a soft-money position, so the requested salary is above the normal 2-month NSF limit for senior personnel. Additionally, two months of salary in each of the first two years and one month salary in the final year for PI Thatcher, who will perform laboratory analyses and assist in all aspects of the research.

**B. Other personnel**

An undergraduate student will be funded for two years at the Northern Arizona University to help with the laboratory preparation of geoduck samples for imaging and isotopic analyses. This will be valuable to the research project and will train the student about proxy records and laboratory methods. The student will be funded in the academic year for 10 hours per week, for a total of 320 hours per year.

An undergraduate student will also be employed at Iowa State University to sample and process isotope analyses. This student will be funded for 136 hours/year for 2 years.

**C. Fringe benefits**

Employee-related expenses (ERE) are rounded estimates based on the projected cost of health, dental, life, disability, FICA and Medicare, unemployment, and retirement benefits relative to the employee's salary and/or wages, FTE, and election of benefits. The employee’s ERE rate is calculated by dividing his/her salary by the total cost of his/her benefit package. Graduate student fringe benefits also include tuition remission and health benefits.

**E. Travel**

Funding is requested for collaborator Edge and PI Erb to travel to one scientific meeting each. These meetings will be useful for sharing results of the research project, and for fostering collaborations with other research groups. Funds are also requested for collaborator Edge to travel to the study area for sampling, meeting with local researchers and stakeholders, and reconnaissance. Travel to the study area will provide first-hand knowledge of the marine environment and improve ties with local stakeholders and collaborators.

**G. Other direct costs**

Funds are requested to help cover the publication costs of one scientific paper per year. These publications are necessary to disseminate the research to a broader audience and advance the scientific field.

Funding is requested for sampling for new geoduck shell by commercial divers in New Zealand. This sampling will add information from the southernmost known population of *P. zelandica*, ~800 km from the nearest existing collection.

Funding is also requested for laboratory consumables for the preparation of geoduck samples and δ18O sampling.

**I. Indirect costs**

Indirect costs are requested at the on-campus research rate of 52% MTDC in accordance with Northern Arizona University's approved *Colleges and Universities Rate Agreement* (August 21, 2008) (Cognizant Agency: Department of Health and Human Services). The Modified Total Direct Costs (MTDC) base consists of all salaries and wages, ERE (except tuition remission); materials, supplies, services, travel, and subgrants and subcontracts up to the first $25,000 of each subgrant or subcontract. The base excludes equipment, capital expenditures, rental costs of off-site facilities, as well as the portion of each subgrant or subcontract in excess of $25,000.